

**Bone mineral density measurements and
the development of patient selection
criteria for patients requiring hip
resurfacing surgery**

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CERTIFICATE OF AUTHORSHIP / ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

A handwritten signature in blue ink, appearing to read "R. Candy", is written over a horizontal line.

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ABSTRACT

There is concern about femoral neck fractures for patients in the early post operative period following hip resurfacing surgery. Although patient selection is multifactorial bone quality plays an important role in fracture risk. Reduced bone mineral mass induces an increased fracture risk on the superior side of the femoral neck before and after hip resurfacing. Close scrutiny to bone quality other than the use of visual inspection of radiographs (Singh Index) to estimate the mechanical quality of the bone has not been closely analysed. A change in bone mass across the femoral neck can be influenced by disease (Osteoarthritis) or a change in load pattern (pain and disuse). If hip resurfacing is the technique of choice, the major difficulty is to distinguish clearly which patient will have a positive outcome without the complication of femoral neck fracture.

Bone mineral density (BMD) measurement is a well known technique for the diagnoses of poor bone mass (Osteoporosis). To date there has been no published data analyzing the effect of bone mineral density examination in patient selection criteria for hip resurfacing surgery.

This is the first attempt to introduce a practical tool for surgeons to assess bone quality prior to hip resurfacing surgery. A prospective longitudinal outcome analysis of 423 consecutive hip resurfacing procedures was conducted to test the validity of the introduction of BMD in conjunction with unique selection criteria. There were 339 patients under 65 years of age (264 males and 75 females). There were 84 patients 65 years and over (61 males and 23 females).

Bone mineral density examination was introduced preoperatively, 6 months, 12 months and 24 months postoperatively to test for bone mass quality. The short form (SF-36), WOMAC health questionnaire, TEGNER activity score and body mass index (BMI) were used to analysis the patient's outcomes, activity and general health preoperatively, 6 months, 12 months, 24 months and 36 months postoperatively.

The results concluded that this was the first time BMD measurements were successfully introduced as a selection tool for patient requiring hip resurfacing surgery. There were no femoral neck fractures after its introduction. I propose BMD examination is part of a multifactorial approach in the selection of patient for hip resurfacing surgery and it is the one determining factor that will ensure the bone is strong enough to cope with this load sharing device.

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Publications

Podium Presentations:

October 2001: Orthopaedic Association for Australia and New Zealand (New Zealand Queenstown)

1. *Predicting Femoral neck fractures in hip resurfacing using bone mineral density.*

October 2002: Orthopaedic association for Australia New Zealand (Melbourne, Australia)

2. *An analysis of Alendronate Sodium in patients undergoing hip resurfacing.*
3. *Birmingham hip resurfacing after failed proximal femoral osteotomy.*

December 2002: Society of Military Orthopaedics (San Diego, America)

4. *A two year survival analysis of patients undergoing hip resurfacing*

August 2003: World congress on Medical Physics and Biomedical Engineering (Sydney).

5. *Hip resurfacing: a 2 year survival analysis*

July 2003: 1st International Hip Resurfacing Forum (Spain).

6. *Short stay hip resurfacing*
7. *Predicting femoral neck fracture in patients undergoing hip resurfacing*

November 2004: 2nd International Hip Resurfacing Forum (Dubai)

8. *Follow-up of 431 consecutive hip resurfacings*

October 2005: Australian Orthopaedic Association Annual Scientific Meeting (Perth).

9. *The effect of femoral component alignment on femoral neck remodeling after hip resurfacing- a finite element analysis.*
10. *Hip resurfacing, Selection criteria and results of 423 consecutive hips at 5 years.*

Awarded Evelyn Hamilton award for best scientific paper

Poster presentations

October 2002: Australian conference of science and medicine in sport (Melbourne, Australia)

1. *Assessing the risk of fractures using bone mineral density measurements in hip resurfacing surgery*
2. *A prospective analysis of Autologous Chondrocyte implant for regeneration of hyaline cartilage in full thickness defects in the knee*

October 2002: World Biomaterials conference (Sydney, Australia).

3. *Assessing the risk of fractures using bone mineral density measurements in hip resurfacing surgery*

February 2003: Orthopaedic research society (New Orleans, America).

4. *Birmingham hip resurfacing: A two year survival analysis.*

May 2004: Biomaterials 7th World Conference (Sydney).

5. *Birmingham Hip Resurfacing: A 2 year Survival Analysis*

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6. *Adaptive Bone Remodeling of Unicompartamental Tibial Bearings*

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